SOME THOUGHTS ABOUT THE ARCHITECTURAL USE OF CONCRETE

Andrew Saint

The premise of this article, which will be published in two parts, is that the mainstream tradition of thinking about the architectural use of reinforced concrete in Britain has been, and remains, incomplete and immature. It goes on, by means of two case studies, to suggest that a richer historical understanding of this most fertile of twentieth-century structural methods can benefit architecture today.

There is a sense in which concrete architecture has never naturalized itself in Britain. At the outset, this may seem absurd. No architect can go far without recourse to concrete construction. From Owen Williams downwards, the list of distinguished British engineers who have been creative in concrete is a remarkable one. Yet prejudice against concrete has played a strong part in Britain’s particular form of the international revulsion against modernism — the revulsion, perhaps, of a culture that has always shown more feeling for pattern-making and texture than for structure.

How far, too, the most popularly acceptable and admired face of British modernism today, the ‘high-tech’ architecture of Rogers, Foster, Hopkins and their disciples, depends for its appeal upon the sleekness of metal construction and the boyish idea of bolting together little bits and pieces! We all know the historical models for this kind of architecture: the Kew Palm House, the Crystal Palace, the London termini and the Chicago skyscraper. Compared with this venerable genealogy, the English-speaking world offers little to the eye that is special or consistent in the way of a concrete tradition in architecture. No wonder that the Brutalist episode, when the vogue for raw concrete was at its height, seems now pretentious and incoherent, however stimulating.

The greatest influences upon an architectural way of thinking about reinforced concrete have, of course, been French, so much so that there has been a tendency — encouraged by the French themselves — to believe that the material’s early development was due to France alone. Auguste Perret and Le Corbusier are the key figures. From Perret, or at least the Perret whom literature, teaching and example have chosen to emphasize, came the habit of conceiving concrete architecture in terms of an exposed, stringent, rectilinear grid consisting of frame and infill. Le Corbusier’s contribution to the tradition has been more complex. But for the most part the heavier, more textured and more sculptural forms of his buildings enrich or react against the Perret grid; they do not represent a wholly separate approach to design. Where the reaction was extreme, as at Ronchamp, the results were profoundly moving and stimulating, yet too individualistic to be subsumed into a lasting ‘language’ of concrete architecture. The insistent demand for the orthogonal in ordinary architectural practice always led back to the grid.

Perret’s mature approach to design is enshrined in Peter Collins’s Concrete (1959), still the only English-language study that deals seriously with the development of a concrete architecture in this century. This book ranks as one of the most creative products of modern architectural scholarship. It is perhaps a better and certainly a more challenging work than Collins’s later Changing Ideals in Modern Architecture. Dense, detailed, literary, allusive, discursive and sometimes over-elaborate in its argument, Concrete packs fact, theory and opinion into a texture which is often hard to unpick. It is really two books rolled into one. The first part is a study, now increasingly dated and in need of revision, of concrete as a building material up to the 1920s: in particular, of reinforced concrete’s emergence as a tool for architecture as well as for civil engineering. The second part is a hymn of praise to the rational classicism of Auguste Perret. Writing when Le Corbusier’s star was at its brightest, Collins expressed a clear preference for the older master, in whom he found the ideal of a humane, poetic and lucid builder in concrete. For all its eloquence, this did little to alter contemporary views.

For Collins, French traditions of structural articulacy and clarity form the proper basis for a concrete architecture. In this he is an orthodox modernist, but a modernist who is a Goth and a Classicist too. Collins, like Perret, points to French Rayonnant Gothic as the source of exposed frame and infill, and to the rationalist current within the École des Beaux-Arts for the origins of the trabeated classicism which Perret was to develop so forcefully. Only in French architecture does he find this structural consistency across the styles, and only in Perret the courage and ability to translate it from stone into concrete. Unsurprisingly, therefore, it is to the French development of concrete as a building material that Collins gives pride of place. He gives some space and credit to British experiments in mass and slab concrete during the Victorian period, to early American contributions to reinforced concrete, and to the graceful bridges of Maillart and his contemporaries. There
are a few allusions also to the German contribution to concrete construction, but it does not take much digging to discover that these are wholly insufficient. It is the French line of development that runs from Cointereaux through Coignet, Monier and Hennebique to Perret and the latter’s international disciples which is at the heart of his book.

Nothing concerted has been written in the last thirty years to shift Peter Collins’s perspective. Students of structural history have begun to unravel the tangled skein of concrete’s early development, but their work seems not yet to have touched architectural thinking. The nearest to a new English-language conception of concrete architecture was provided by Reyner Banham in his last book. A Concrete Atlantis jolted us into appreciating the splendour, rationality (in a different sense from French ‘rationalism’) and sheer hard-headedness of American industrial architecture in reinforced concrete in the first years of the century. But Banham’s time was, alas, short. So he contented himself with looking at and enthusing over what he saw and with the narrow task of trying to relate it to European images of the New World, rather than making any wider sense of it. It is to this task that the case studies which follow are — cautiously and partially — dedicated.

Case Study I

EARLY REINFORCED CONCRETE IN LONDON

One of the difficulties about the history of reinforced concrete is that it has no agreed starting-point. Concrete, whatever its precise ingredients, is a fairly simple material with ascertainable properties of strength. It is not an elaborate idea to encase load-bearing iron or steel members with cement-concrete to provide a solid, fire-resistant surface, nor a great leap from that to bolstering up the strength of mass or slab concrete with thinner lengths of iron reinforcement. Trials with the former method go back almost as far as the start of iron ‘warehouse construction’ in the very early nineteenth century. That is usually defined as ‘fireproofed metal construction’. Attempts at reinforcing the joints between brick arches with iron strip have been traced back to experiments of the 1830s by Marc Isambard Brunel in connection with the Thames Tunnel. But reinforced concrete proper is generally held to begin with the patents of W. B. Wilkinson (1854) and François Coignet (1855).\(^1\)

The first regular, tried and trusted combination of iron or steel with concrete in both Europe and the United States was a particular application of fireproofed metal construction: the flat fireproof floor, with ‘filler joists’ of iron. The earliest successful British method was Fox and Barrett’s, devised for a private lunatic asylum in Gloucestershire during the 1830s but not patented till 1844; other systems followed, and one or another was in standard use in warehouses, housing and offices by the 1880s. The concrete-sealed version of the fireproof floor (in another version, the beams could be covered with terracotta in addition to or instead of concrete) is an important harbinger of reinforced-concrete construction. But it has never been invested with much glamour in structural history, in part because it is a matter of just one element in a building rather than a complete ‘system’ of construction. Architects especially (engineers are less finicky) tend to like pure, visible, complete systems of construction in a single technique. But the whole history of concrete design down to the present day is shot through with buildings involving a combination of structural methods. People persist in talking about buildings with a concrete frame or a steel frame, but very many buildings combine the two. All successful modern structural techniques have to be able to meet a variety of briefs and purposes. A prejudice in favour of structural purity rarely stands up to rational examination, least of all in concrete construction.

Concern with the ‘scientific’ combination of iron or steel and concrete can also be a distraction from the true course of events. This, perhaps, is the engineers’ heresy. Patents and experimentation were important in the historical evolution of reinforced concrete. But so too in the British context was sheer experience in building.

From the 1860s onwards there was a lively, continuous Victorian tradition of constructing in concrete as a means of economy. The fruits of this tradition are far more widespread and numerous than Collins appreciated. Many complete mass-concrete buildings were built in Britain during the last thirty-five years of the nineteenth century: plenty of houses (Figs. 1, 2), quite a few churches and halls, and at least one experimental bridge. There were also a number of block-concrete buildings (this tradition goes back at least to the 1830s), a few timber-framed ones with concrete cladding,
and so many in which lintels, window frames, floors or other elements are of concrete as to be unremarkable. What is remarkable is the regularity with which that tradition fails to draw attention to itself. Even when a building is, in structural terms, almost wholly of concrete, it will usually deny its nature with a coating of cement, roughcast or tile-hanging. Sometimes it is even dyed red, to look like brickwork. That reticence of expression, so puzzling and irritating to the ethic of modernism, can be ascribed to three factors: caution about the weathering properties of concrete, which time has too often borne out; caution about the aesthetic tractability of concrete, which time and opinion have entirely borne out; and a sense of inferiority, arising from the fact that concrete was usually adopted *faute de mieux*, for cheapness. Far from conceiving that concrete should determine style, builders and architects had a strong sense of the need for its architectural subordination.

The earliest British buildings in which ‘reinforcement’ (as opposed to fireproofed metal construction) is known to make an appearance belong to this cheap, empirical and stylistically humble tradition of building. One — and it is likely to be just one of various examples constructed with little or no publicity — is Gilbey’s gin-bottling plant in Jamestown Road, Camden Town, of 1894, where thick mass-concrete walls are reinforced in a crude way with hoop iron.3 Another case is that of the builder W. H. Lascelles’s thin concrete slabs on a timber or concrete frame, successfully exploited for some years after 1875 (Figs. 3, 4). Sometimes the slabs were inlaid with iron rods to give them extra strength, though they were never load-bearing. The Lascelles system was skilfully marketed with the help of a pair of books of designs in the Queen Anne style put out by Norman Shaw and Ernest Newton, which earn it some withering remarks from Collins.4 The implication is that concrete


4. 237–239 Sydenham Road, Croydon, c.1878. Lascelles slab construction concealed by tile-hanging and brick chimneys. After a design perhaps furnished by Norman Shaw.
ought to find its own expression. That some degree of subordination to existing styles and co-ordination with other materials may be right and proper Collins does not for a moment consider.

France was the immediate country of origin when 'scientific' reinforced concrete arrived in Britain at the end of the 1890s. The reasons why the French were ahead of the field, particularly in exporting concrete-building systems, are not fully known; but experts now stress the stimulus of Joseph Monier's patents of the 1870s.

Hennebique, the leading French firm, was first in the field in Britain. Hennebique's British licensee was L. G. Mouchel, and the many reinforced-concrete buildings and engineering works constructed with the Hennebique patents in Britain, from Weavers Mill, Swansea (Fig. 5), of 1897 onwards, were referred to as by L. G. Mouchel and Partners. The years between Weavers Mill and the First World War were critical to the development of reinforced-concrete architecture throughout the industrialized world. During that period, Mouchels carried out a wide range of British commissions: complete multi-storey buildings with walls, floors and internal supports of reinforced concrete 'components'; and large engineering works such as retaining walls and basins for docks and harbours. Until about 1905 the firm enjoyed something like a monopoly. They worked more in some parts of Britain than others; Newcastle and the northeast, for instance, seem to have taken particularly to reinforced concrete warehouses (Fig. 6). This may have been because building regulations, so often hostile to new materials, were more flexible in that part of the country.

The outsides of early Mouchel buildings are rarely of any account, but some of the interiors contain arched forms that verge upon elegance. The reason for the crudity of the exteriors is simple; the new technique was adopted by its first British clients for its cheapness. Since one advantage of reinforced concrete was to thin down the external wall, it would have been strange if clients had then wasted money by elaborating it. Almost all the very early completely Mouchel buildings were sheds, mills and warehouses. Issues of civic grace or long life did not arise with such buildings. They were — in a word — ugly. As for the internal articulation, this seems often to have been the best or only way the early Hennebique system could meet some particular structural need in the brief. There is no indication that Mouchel or anyone on his staff had the least interest in aesthetics. For whatever reason, these arches seem to have been phased out of the firm's vocabulary quite quickly.

Mouchels two most important early clients in the southeast were large organizations: big enough to be interested not just in buildings on a one-off basis, but in a method of efficient, economical construction, which reinforced concrete was quickly seen to offer. These clients were the Great Western Railway and the General Post Office. For the GWR, for instance, Mouchels designed in 1899 a warehouse at Brentford, long demolished; in 1900 London's first complete reinforced-concrete building, an open coal and goods depot at the Royal Albert Dock (regrettably demolished in 1988); and in 1906–7 a stationery store in Porchester Road, Paddington. The stationery store is extant, at the edge of the railway tracks, its internal concrete frame here faced in brickwork. Architects were not involved with any of these buildings. The GWR engineer, W. Y. Armstrong, or an assistant under Armstrong decided what they would look like. 6

The case of the GPO is more interesting. Post offices were designed by salaried architects working within the Office of Works, a government department. The Office of Works was always under pressure from the Treasury to design and build more economically, and under criticism from private architects for keeping work 'in-house' and for producing ugly buildings. In the Edwardian period the Office of Works' Chief Architect was Henry Tanner, an indefatigable public servant and a better-than-competent designer. In about 1904–5 Tanner became alert to the economic advantages of reinforced concrete and, arguing cost savings, requested Treasury approval to use it for a series of large postal sorting offices then in contemplation. A Mr Farnell of the Post Office's Building Branch was deputed to investigate. He examined the reinforced-concrete piers of the new Ritz Hotel foundations, just then being put in according to the 'Columbian system', already familiar in America; and he reported on the reductions in wall thickness made possible by reinforced concrete.

The first and most important result of Tanner's initiative was the large King Edward Building of the GPO on a prominent site in the City of London, facing King Edward Street and Newgate Street (Fig. 7). It was built in 1907–9 using the Hennebique-Mouchel system. Tanner was the nominal architect, but it may be hazarded that the real designer of the building was his principal assistant and eventual successor, Richard Allison. What is significant about the King Edward Building is that it conforms with greater sophistication and self-consciousness the attitude towards concrete of the old mass-concrete builders. Where the building is public and visible,
7. The General Post Office's King Edward Building, City of London. Sir Henry Tanner of the Office of Works, architect, with Richard Allison, assistant, 1907–9. **TOP LEFT:** The disciplined Portland stone front on Newgate Street concealing the Hennebique–Mouchel framed structure. **TOP RIGHT:** Interior of main post office, where marble and plasterwork cover the frame. **BOTTOM LEFT:** The northeast corner of the sorting office in 1987, showing the roughcast finish over the less visible portions of the building; the surfaces and fenestration have since been renewed. **BOTTOM RIGHT:** Interior view of one the large sorting offices showing typical early arches and closely spaced beams of the Hennebique–Mouchel system.
the reinforced concrete is hidden away. The two street fronts are ably clad in Portland stone and granite, while the main post office interior is a fine Edwardian space with marble veneer on the columns and a fruity plaster ceiling hiding the Hennebique beams. To appreciate the construction you have to go behind and look at the vast sorting office, all but a Portland-stone-clad sliver of which was originally hidden from public view. Here, as well as on the back of the King Edward Street post office block and on the bridge linking the two, the elevations consist of a thin, bald concrete wall covered by a cement render. Inside, there are nice shallow transverse arches in the main spaces — the only aesthetically worthwhile gesture in reinforced concrete throughout the building.

The success, economic as much as architectural, of this large government building in the heart of London did much to make reinforced-concrete construction accepted in Britain. The Office of Works built several more sorting offices in the material, followed in 1911–14 by big new headquarters for the Stationery Office: Cornwall House, Stamford Street, Lambeth, a two-part project similar in nature to the GPO. Here Richard Allison, now in charge, made a brave attempt to impose classical discipline on the cement-rendered concrete wall. This was the bigger, warehouse element, which obstructed upon three streets. The small office-block facing Waterloo Road remained resolutely stone-clad.

The reason for the primacy of the GWR and the GPO in the spread of reinforced-concrete construction was the broad exemption they enjoyed from the rules of the London building acts. Until 1908, the cautious interpretation of these rules by the London County Council’s architects much inhibited the use of reinforced concrete. To sneer at the conservatism of regulatory authorities is too easy a sport. They had a duty to protect lives from collapse and fire. The LCC had looked into the Hennebique system in 1899–1900, but were put off by the collapse of a pile at Southampton Docks and came to no final conclusion. This indecision had less to do with the attitudes of municipal architects or bureaucrats than with the say-so of the London Fire Brigade, whose hard experience with building failures made them wary of new materials. The real difficulty was that there were no national or municipal facilities for building-research. For a time the district surveyors had local discretion. In practice stipulations about wall thicknesses, for instance, were stringently interpreted. This caused Mouchel to complain to the RIBA in 1904 that ‘at the present time London enjoys the unique privilege of being the only town in the civilised world where ferro-concrete constructions are actually prohibited’. That is an exaggeration. In New York, for instance, reinforced concrete was also a late-comer for the simple reason. Collins dates New York’s first complete reinforced-concrete buildings to 1905. What is undoubtedly true is that such caution dovetailed with the belief — hardly dented by the nineteenth-century ‘iron revolution’ — that any self-respecting urban building should pay heed to its context by means of a brick or stone external wall.

If municipal caution was to be broken down, a disinterested case for reinforced concrete had to be presented. The person to take this initiative was Edwin O. Sachs, a remarkable Anglo-German architect who can be claimed as the father of modern British building research. Almost single-handedly, Sachs had started the British Fire Prevention Committee in 1897. The BFPC carried out a series of tests at its little Paddington testing station (Fig. 8), and published a series of inquests into urban fires (notably a big fire of 1904 in Baltimore). This proved finally that, as a fire-resisting material, reinforced concrete had the edge over fire-proofed metal construction (at least where the fire-proofing was in terracotta).

After 1905, rival systems to Hennebique–Mouchel began to proliferate; Coignet and Considère (French), and Kahn and Columbian (American) were the principal competitors. Seeing that there was little objective information about the systems, Sachs went on in 1906 to establish and edit Concrete and Constructional Engineering, and in 1908 to found the Concrete Institute, now the Institution of Structural Engineers. The journal in particular helped confused architects through the minefield of concrete building systems. Meanwhile the RIBA and the engineering institutions set up the Joint Committee on Reinforced Concrete, which met under Henry Tanner’s chairmanship in 1906–7. Its report formed the basis of LCC draft regulations for reinforced-concrete construction. Because of continuous changes in technique, these were published only in 1913 — and were obsolete almost as soon as they had been issued. The need for building regulations based on performance specifications was beginning to appear, though these were to take years to achieve. But such was the change of climate that from 1908 the LCC felt able to instruct its district surveyors to take a more liberal line towards reinforced concrete and not to insist upon the extra wall thicknesses prescribed by the building acts. The
first beneficiary was the Spillers Silo on Bermondsey Wall West (Fig. 9), a lofty box designed in the Hennebique–Mouchel system by W. T. Walker, one of a small group of little-known British industrial architects who took up reinforced concrete from an early date. This silo, demolished without proper record in 1988, was one of many recent losses among early reinforced buildings.

At least in London, therefore, reinforced-concrete structures were rare before 1908 (coincidentally the date of the energetic Mouchel’s death), increasingly popular thereafter, and by the time of the First World War near commonplace. But most buildings with any architectural pretensions of the years 1908–14 did not display the material. Concrete was considered drab, mean, banal and lacking in textural quality; urban clients, architects and estate owners alike simply did not want it, except where it did not seriously show. Often these more mannerly and costly buildings that concealed their construction behind a veneer of brick or stone were of greater interest than the cheap warehouses where concrete elevations were permitted. Yet the structural puritanism of later critics, Collins among them, has meant that such buildings are dismissed as of little or no architectural value.

Take for example the two earliest London buildings constructed in the Kahn (later Truscon) system, the influential American system first used in Detroit in 1905 and quickly imported into Britain by Albert Kahn’s brothers, Julius and Moritz Kahn. Both were City office buildings: Friars House, New Broad Street, built to designs by Arthur Blomfield junior in 1907–8; and Portland House, Lloyds Avenue, designed by the veteran Norman Shaw as the headquarters of the Associated Portland Cement Manufacturers a few months later. Both buildings were erected by the same combination of contractor (Holland and Hannen and Cubitts) and specialist (D. G. Somerville and Co., British licensee for the Kahn patents). Both had conventional fronts in Portland stone and glazed-brick rear elevations; the structures were in the Kahn system throughout, but heavily plastered so that not a panel of concrete showed anywhere. It is a sad commentary on conservation values (which usually follow on at a safe distance from architectural values) that both these buildings have been gutted so as to preserve the fronts, which have no special interest, but destroy the structures. This happened to Portland House in 1971–2, to Friars House in 1988 (Fig. 10).

Many big London office buildings of the five years before the First World War take the same pragmatic line. The thriving commercial architects Gordon and Gunton, for instance, favoured the Considère system, as in their International Buildings and Kingsway Hall, Kingsway; their Royal Insurance Building, Lombard Street; and their British-American Tobacco Company offices, Millbank. All these, like the King Edward Building, have traditional Portland stone fronts and rich plastered interiors. Many further examples could be cited; nor does the London approach differ significantly from that to be found at this date in other European cities. Even Perret clad his early Parisian buildings in ceramics or stone. Concrete construction, in other words, reached early urban maturity as a way of combining elegance in traditional materials with a new freedom of internal plan — a freedom often greater than that afforded by steel-framing, also coming into general use at the time.

The better class of London warehouse or factory tended by this time to conceal its concrete frame behind brick fronts. The GWR Stationery Store has already been mentioned. Among later examples it is worth singling out the former Orchestrelle Factory in Silverdale Road, Hayes, of 1909–11 (Fig. 11). Here brick piers and arches designed by Walter Cave (in the reduced-Westminster-Cathedral style espoused by Beresford Pite) fit on to a concrete frame devised by E. P. Wells, one of the few pre-war British
partly because he cannot repress the prejudice that people ought to have been working towards the kind of expression represented by the post-and-beam, ‘rational’ classicism of Perret’s maturity. Such a development might have been possible for the cheap, repetitive, framed warehouse or factory, recognizable for what it was both out and in, with which reinforced concrete first made its mark as an independent system of building. But these were far from the only types of building for which concrete suggested hopes of architectural development. For certain kinds of multi-purpose building (offices), it offered new flexibility of plan in relation to structure; for simpler building-types (bridges, halls, churches) it offered the opportunity, just emerging, of new spans combined with a new aesthetic expressiveness through the medium of the concrete arch or vault. I shall explore the emergence of this tradition in the second case-study.

I end this first case-study, then, not by reference to any debate, but with three examples of buildings that illustrate different ways in which reinforced concrete was starting to influence architectural expression in London — a structurally conservative city, but by no means unique in its conservatism — in these early, experimental years of the material’s history. None of them has the least connection with the concrete tradition developed by Perret and Le Corbusier between the wars, but all are interesting structures which suggest uncompleted lines of architectural development.

The first is the former Clays Printing Works in Paris Garden, Southwark, built with the Kahn system in 1909–10 to the design of G. F. Collinson (Fig. 12). Happily extant (though the fenestration has recently been altered), it is the one pre-1914 London building that attempts to do something special with the elevational organization and massing of a concrete building. The long street front is by no means unhistorical; indeed there is a flavour of Voysey and perhaps a little of Vienna in the details. But it is unmistakably a concrete building, with the bluntness and weight that is one characteristic of the material. It points to a mild expressionism of concrete form never to be fulfilled in English architecture. Clays is entirely forgotten today. But there were technical articles about it at the time of its construction, while a commentator in 1926 remarked upon it: ‘This building stands after fifteen years as a fine example of reinforced concrete, and a record of the weathering properties of concrete in London atmosphere.’

The second example is a maverick, but an instructive one: the goat hills atop the Mappin Terraces at London Zoo, built in 1911–12 to J. J. Joass’s designs (Fig. 13). These consist of free concrete forms sprayed on a mesh and supported by a concealed forest of Kahn beams, posts and trusses. Visually, they are more in the spirit of the Earl’s Court and White City exhibitions and of Edwardian theatrical showmanship than that of progressive architectural endeavour. Yet they demonstrate the versatility and expressiveness possible through reinforced concrete every bit as much as Tecton’s Gorilla House or Penguin Pool.

Last comes an industrial building which borrows a good deal from the American tradition in early concrete architecture: the former Ford Maintenance Depot at Brook Green, Hammersmith (1915–16) (Fig. 14). This brick-faced building, designed by Charles Heathcote and Sons of Manchester, might have been more interesting still. It is three storeys high, but was meant eventually to be five. What is more, it was supposed to be built in ‘flat-slab’ construction, with mushroom-headed columns instead of visible beams, a technique by then coming into common use in the United States but one against which the LCC continued to set its face until the 1930s. Still, it is remarkable enough: a clean, rectilinear grid of pier, spandrel and metal window, not so far removed from the curtain wall. Evidently it owes much to the car-factory tradition.

established by Albert Kahn at Detroit. Despite its wartime date, the building has been smartened up for urban consumption with streamlined, two-tone brickwork and classical cartouches at the heads of the piers. But no one who knows much about architecture would doubt that it was a concrete building, as they might with the Orchestrété Factory; to alleviate doubt, the framing of the floors is allowed to show on the south flank wall, delighting any enthusiast for ‘revealed construction’ who walks or pedals or drives up the Shepherds Bush Road.

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Notes
2. A random list of early surviving buildings in the London area known to be wholly or largely of concrete will give some idea of how frequent the practice had become by the 1880s. Block concrete: Royal College of Surgeons, Lincoln’s Inn Fields (1836–7, using William Ranger’s concrete blocks); 53 Beech Hill, Enfield (c. 1880). Mass concrete: Albion Villas, Albion Road, Bexleyheath (Joseph Tal’s system, 1868); 44–46 Victoria Road, Mortlake (also Tall, 1870); St Sepulchre’s School, Snow Hill Court, City of London (1874–5); 21 Idmiston Road, Norwood (c. 1875); 12–14 Willow Road, Hampstead (1879); 11 Belvoir Road, Dulwich, and other houses nearby (c. 1880); 16 St Peter’s Road, Iselworth (1883); Swedenborgian Church (1883) and adjacent houses, Waldegrave Road, Norwood; Palace Theatre, Shaftesbury Avenue (1889). Lacelles’s slab concrete: 226–228 and 237–239 Sydenham Road, Croydon (c. 1878); additions to 19 Park Hill, Carlshalton. These doubtless represent the tip of an iceberg. In other parts of Britain, notably Hampshire and the Thames estuary area of Kent and Essex, concrete houses were commoner.
3. English Heritage, London Division, Historians’ File CAM 136, report by Neil Burton of the GCL Historic Buildings Division, 1984, based on company records. The designer and builder was William Hacks, a ‘jack-of-all-trades’ who had started with Gilbey’s as their head distiller and branched out into construction.
6. Casuck, Ph.D.; Greater London Record Office, AR/Ba/3/1. The Porchester Road stationery store was published in Concrete and Constructional Engineering, 1906–7, pp. 113–5, and W. Noble Twelvetrees, Concrete-Steel Buildings (1907), pp. 47–53. Interestingly, it seems to have been constructed on the site of the British Fire Prevention Committee’s early testing station.
12. W. T. Walker and the Spillers Silo: The Builder, 13 June 1930, p. 1147; RIBA Library, Fellowship Nomination Papers, 1906. Walker also designed the Clement-Talbot Motor Works, Barby Road, North Kensington, which has an early reinforced-concrete structure. Another architect of interest was A. Alban H. Scott (1878–1944), partner in Scott, Hanson and Fraser. He was author of the pamphlet The Planning and Construction of Factory Buildings with Special Regard to the Application of Armoured Concrete (1905) and of the book Reinforced Concrete in Practice (1915), and had a large pre-war and inter-war practice. His most important early reinforced-concrete building in London, a polish factory at what is now called the ‘Hogarth Roundabout’, has been demolished.
15. Concrete 21, 1926, p. 55. For Clay’s works see also Building News, 30 March and 7 April 1911; The Builder, 25 January 1912.
17. Concrete and Constructional Engineering, 1918, pp. 70ff. and 161. The connection between the Brook Green Building and Detroit is not quite clear. Ford’s first British buildings were at Trafford Park, Manchester. Charles Heathcote and Sons had been their architects at Trafford Park and went on to design their earliest Dagenham plant in the 1930s. The Brook Green depot was Ford’s first venture into the south of England. It seems to have had a wartime connection with the Orsam factory next to it, which was converted from producing light bulbs to vehicle valve production at the outbreak of the First World War. Heathcote (1850–1938) was perhaps Britain’s most experienced industrial architect of the early twentieth century. He had built many factories at Trafford Park, including the British Westhinghouse Factory (1900–02), an early case of collaboration with American designers and contractors. See Edgar Jones, Industrial Architecture in Britain 1750–1939 (1985), pp. 209–11.
18. I am grateful to David Yeomans for showing me the draft of a paper on early flat-slab construction in Britain. The earliest extant flat-slab building in London appears to be a portion of 19–23 Harbet Road, Paddington, a Selfridges warehouse of c. 1920 designed by the architects Ellis and Clarke and the well-known engineer Sven Bylander. See Architects’ Journal, 16 March 1921. On the face of things, it would seem that this warehouse contravened LCC regulations. Mailart in Switzerland and various Americans had by then been using ‘flat-slab’ for quite some time.

Figs. 1, 4, 7, 9, 10, 11, 13 (right), 14: English Heritage. Figs. 5, 6: British Architectural Library / RIBA. Fig. 12: photographs by Valerie Bennett. Fig. 13 (left): © Zoo Operations Ltd, courtesy of Zoological Society, London.